HEIT

Cat. File 1392 4

Special Price List - Fall '61 and Spring '62
of
Exotic and Miscellaneous Conifers
(Some rare and choice evergreens for arboretum purposes or trial for Christmas trees)

	Age	Size	Per 10	Per 100
Abies balsamea (Balsam Fir)	3-2	6-12"	$ 2.00	$ 12.00
" " " "	3-0	5-10"	1.00	6.00
" fraseri (Fraser fir)	3-0	6-12"	1.00	7.00
" grandis (Grand fir)	2-0	4-10"	1.00	8.00
" homolepis (Nikko fir)	3-0	4-8"	1.50	10.00
" magnifica (Red Fir)	2-1	4-8"	1.50	10.00
" nobilis (Noble fir)	2-1	4-8"	1.50	10.00
" veitchii (Veitch fir)	3-0	3-6"	1.50	10.00
Picea bicolor (Alcock spruce)	2-0	4-10"	2.00	8.00
" koyamai (Koyama spruce)	2-0	5-12"	1.50	6.00
" omorika (Serbian spruce)	2-0	6-12"	1.50	8.00
" orientalis (Oriental spruce)	2-1	4-8"	2.00	10.00
" " " "	3-0	5-10"	1.50	8.00
" " " "	2-0	4-8"	1.00	6.00
" polita (Tigertail spruce)	3-2	5-10"	2.00	12.00
" " " "	3-1	4-8"	1.50	8.00
Pinus aristata (Bristlecone pine)	2-0	2-4"	1.00	5.00
" densiflora (Japanese Red Pine)	2-0	2-5"	1.00	6.00
" edulis (Nut pine)	2-0	3-7"	1.50	7.00
" monophylla (Singleleaf pinyon pine)	3-0	3-6"	1.50	7.00
" leucodermis (Balkan pine)	2-2	4-7"	2.00	12.00
" " "	3-0	3-6"	1.50	6.00
" poiretiana (Corsican pine)	2-0	2-5"	1.00	6.00
" thunbergii (Japanese black pine)	3-0	5-12"	2.00	8.00
" " " "	2-0	2-5"	1.00	6.00
Larix leptolepis (Japanese Larch)	2-0	10-30"	2.00	10.00

(50 or more per 100 rate)

All above conifers have been winter hardy in nursery at Geneva, N. Y. Many of above kinds are in small supply - only 50 to 500 available. If anxious to secure any please order AT ONCE and send cash with order. Will ship any desired time.

C. E. Heit
15 Lyceum St.
Geneva, N. Y.

Dr. Steiner —

Here are my new lists as per your letter of Aug. 15. Yes, Fred Bergman has purchased Balkan Pine & other ex stock from me.

C E Heit

C. E. Heit, 15 Lyceum St., Geneva, N. Y.
Price List - Fall '61 and Spring '62

Evergreen Transplants
(Stocky, well-rooted - ready for lining in field)

	Age	Size	Per 100	Per 1000
Picea excelsa (Norway spruce)	4 yr.	7-14"	$ 10.00	$ 80.00
" " " "	3 yr.	5-10"	7.00	50.00
" Koyamai (Koyama spruce)	4 yr.	6-12"	10.00	70.00
" polita (Tigertail spruce)	4 yr.	4-8"	8.00	60.00
" pungens glauca (Col. Blue spruce)	4 yr.	5-10"	12.00	90.00
" " " " " "	3 yr.	4-8"	8.00	70.00
Pinus leucodermis (Balkan pine)	4 yr.	4-7"	12.00	80.00
" nigra (Austrian pine)	2 yr.	3-6"	7.00	50.00
" mughus (Mugo pine)	3 yr.	3-5"	8.00	50.00
" strobus (White pine)	3 yr.	5-8"	7.00	50.00
Scotch pine (Boonville, good green)	2 yr.	3-8"	6.00	45.00
Douglas Fir (Blue and Green)	3 yr.	4-8"	7.00	50.00
Pyramidal Arborvitae (From seed)	4 yr.	8-16"	12.00	80.00
" " "	3 yr.	5-10"	8.00	60.00

Evergreen Seedlings
(Stocky, grown in low density seedbeds)

Picea excelsa (Norway spruce)	3 yr.	6-14"	5.00	35.00
" glauca (White spruce)	3 yr.	6-12"	6.00	40.00
" pungens glauca (Col. Blue spruce)	3 yr.	6-12"	7.00	50.00
" " " " " "	2 yr.	5-10"	6.00	40.00
" omorika (Serbian spruce)	2 yr.	6-12"	8.00	50.00
" orientalis (Oriental spruce)	3 yr.	5-10"	8.00	50.00
" " " "	2 yr.	4-8"	6.00	40.00
Pinus leucodermis (Balkan pine)	3 yr.	3-6"	6.00	50.00
" " " "	2 yr.	2-4"	5.00	40.00
" nigra (Austrian pine)	2 yr.	3-6"	5.00	30.00
Pinus edulis (Nut pine)	2 yr.	3-7"	7.00	50.00
" monophylla (Single Leaf Pinyon pine)	3 yr.	3-6"	7.00	50.00
" sylvestris (Scotch pine) Boonville, Spanish, French, Scotland, Turkey, Greece, etc.	2 yr.	Varies with source	5.00	25.00
Abies concolor (Concolor Fir)	2 yr.	5-8"	7.00	40.00
Douglas Fir (Blue - glauca sources)	3 yr.	8-15"	7.00	45.00
" " " " "	2 yr.	6-12"	6.00	35.00
" " (Green or Grey Sources)	2 yr.	6-14"	5.00	35.00
Pyramidal Arborvitae (From Seed)	2 yr.	4-8"	6.00	30.00
Taxus capitata (Upright Yew)	3 yr.	5-8"	15.00	120.00

(400 or more of a kind per 1000 rate)

Taxus varieties - Transplants

Taxus Brevifolia, Intermedia, Hicksii, Cuspidata nana, Cuspidata spreading, Wellslyana - Hatfieldi 2 yr. trans. (from cuttings)			30.00	250.00
Taxus Upright (from seed)	4 yr. tr.	7-15"	30.00	250.00
" " " "	3 yr. tr.	5-10"	25.00	200.00
" Capitata (from seed)	4 yr. tr.	7-14"	30.00	250.00
" " " "	3 yr. tr.	4-8"	20.00	150.00

All stock was grown from excellent seed source in low density seedbeds, properly fertilized to produce a well-balanced seedling of good color and vigor. Scotch pine strains were selected for excellent green color for Christmas tree production. Have several known sources which can be kept separate if requested. Stock will be reserved and shipped any desired time. Most items are limited in supply so order early. Several seed sources of Douglas Fir are also available for Christmas tree planting. Please send cash with order or 1/3 down payment for Spring '62 shipment.

Tree Seed Testing in the Laboratory

. . . and Practical Aspects in Field Plantings

By C. E. Heit

Seed Technologist, Department of Seed Investigations, New York State Agricultural Experiment Station

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Tree Seed Testing in the Laboratory

. . . and Practical Aspects in Field Plantings

By C. E. Heit

Seed Technologist, Department of Seed Investigations, New York State Agricultural Experiment Station

Nurserymen, foresters and planters of tree seeds have become more seed-quality conscious in the last 10 years. It is well that they have begun to realize the importance not only of planting good seeds, but also of obtaining seeds of high germination from dealers and collectors. Nurserymen should be just as much concerned about the planting value of the seed stocks they use as farmers and vegetable growers are about their agricultural seeds. The writer has had the opportunity the past 30 years to be closely associated with tree seed studies both in the laboratory and in the field. Field studies were conducted at a large commercial nursery many years ago, at the New York state conservation department forest tree nursery between 1932 and 1940 and in a little personal experimental seedling and transplant nursery since 1940.

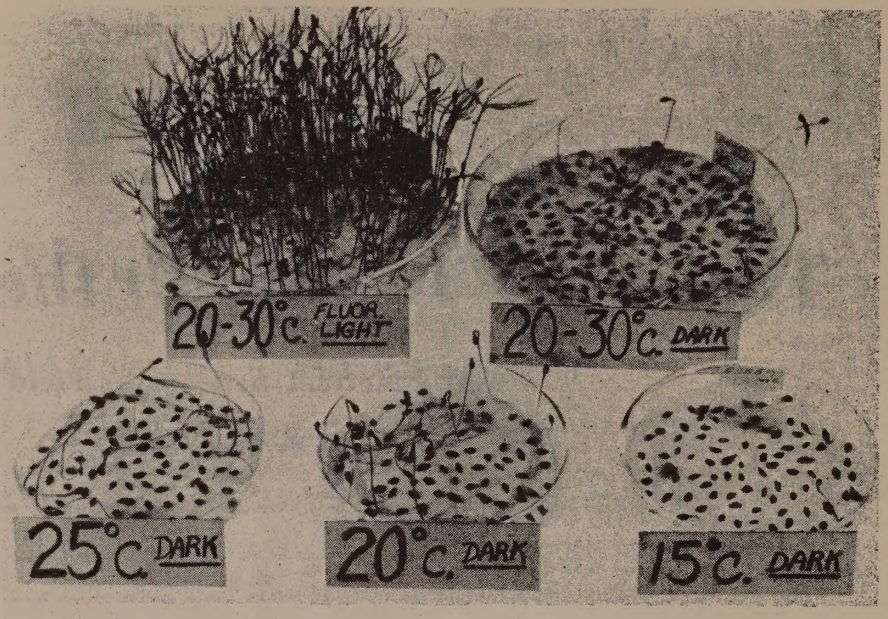

Fig. 1—The effect of artificial light and temperature on the germination of Scotch pine seeds. Artificial light and 20 to 30 degrees centigrade alternating temperature produced 90 per cent germination in 10 days.

Laboratory Germination Tests

Nurserymen have thought in the past that tree seeds cannot be accurately tested for germination in the laboratory as are other kinds of seeds. Some seed dealers and collectors have also clung to this belief for one reason or another and have even passed such information to the buyer of seeds either through their catalogs, correspondence or conversations.

From 1932 to 1940 tree seed testing was carried on by the writer at the Saratoga state nursery, and these findings were published in 1940 jointly with E. J. Eliason in a bulletin entitled, "Coniferous Tree Seed Testing and Factors Affecting Germination and Seed Quality." Since 1940 seed testing and research studies at the New York agricultural experiment station have resulted in the development of reliable procedures for determining the germination of over 100 tree seed species in tests conducted by the laboratory staff.

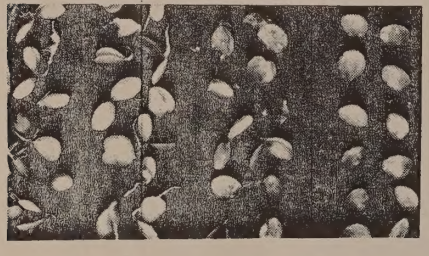

Fig. 2—Comparison of vigor and growth of four peach seed stocks tested by the embryo excision method: A, strong seeds, vigorous growth; B, good seeds, fair vigor; C, old seeds, weak, doubtful value; D, dead seeds, worthless for planting. Actual germination of these stocks when properly afterripened was about 80 per cent for A, 52 for B, 18 for C and 0 for D.

It has been the general opinion that most spruces, pines, firs and cedars needed a stratification or moist prechilling period of from one to two months for prompt, complete germination. With modern, automatic germinators in which temperature, light and moisture are under optimum control for the individual kinds of tree seeds, no prechilling is necessary for most of these species. Alternating temperatures and artificial light have been two critical factors which have stimulated many of the coniferous tree seeds to germinate rapidly. The effect of artificial light and temperature on the germination of Scotch pine is shown in figure 1. This test was completed in 10 days under optimum conditions.

Many hardwood tree and shrub species can be tested for germination in the laboratory without special treatment, such as the Siberian elm. Seeds of this species germinated promptly in a test completed within one week. Such seeds lose their viability quickly, especially under unfavorable storage conditions, and it is essential to test such seeds before sowing. Last spring several elm seed samples being offered for sale were tested in our laboratory and found to be unfit or of doubtful planting value.

Testing Extreme Dormant Seed

Extreme dormant seeds, such as fruit stocks, white ash, bittersweet, barberry, certain conifers and many hardwood and shrub species, can be tested by the embryo excision method within five to 20 days. The embryos of these seeds are removed and placed in closed dishes under optimum temperature and light con-

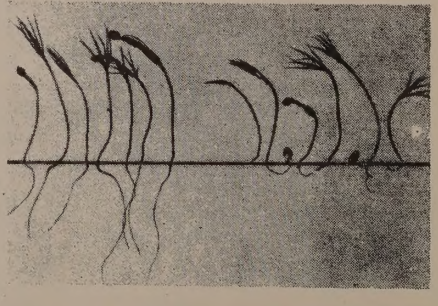

Fig. 3—Normal and abnormal germination of red pine in laboratory test. Seeds had been injured in dewinger during cleaning process. These rootless seedlings have no planting value.

ditions. Various techniques of soaking the seeds, other pretreatments and excision procedures are necessary, depending on the type and structure of the seeds to be tested. These excised embryos will show varying degrees and different types of growth and behavior. The embryos of good seeds will perform satisfactorily by actual germination or typical reaction, while the dead and weak embryos will soon mold severely or decay.

Nearly 100 different tree and shrub species have been tested successfully by this embryo excision method within five to 20 days at

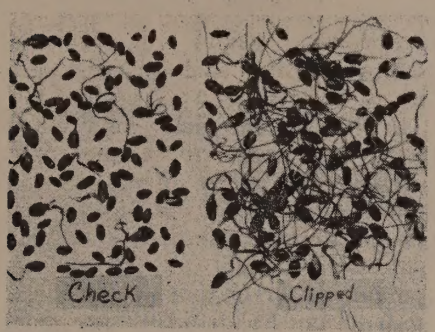

Fig. 4—Testing the value of hard seeds in Carolina allspice, Calycanthus floridus. Clipped seeds absorbed water and germinated promptly. Check lot with no treatment exhibits high percentage of hard seeds.

the Geneva laboratory during the past 15 years. Many of these seeds would require two to four months for normal germination of afterripened seeds. Comparative tests have shown this method essentially accurate for planting purposes.

Nurserymen in New York have had failures in field stands of peach, cherry, apple and plum seeds, even with new-crop seeds some years. At present, the wise and progressive nurserymen always have their fruit stocks tested before planting their pits. Four peach stocks tested at the laboratory by this "quick" method are shown in figure 2. Two of these samples were unfit for planting, and the pits of the other two good stocks could be spaced to secure the desired row stand in the field according to the germination test.

What Do Tests Reveal?

Laboratory tests reveal many practical things which are of value to the nurseryman in the planting and production of his nursery stock. They give the germination percentage or true planting value of each lot tested. Laboratory tests reveal weaknesses, injuries and abnormalities in stocks as these seeds germinate and attempt to develop into typical seedlings of their kind. Old seeds of weakened vitality are readily distinguished from strong, healthy seeds in a laboratory test performance. It is known from comparative field tests vs. laboratory tests that these slow-germinating, weak, abnormal seedlings have no nursery field value and cannot be counted as germination percentage. Extraction injuries may be detected in conifer tree seeds, as shown in figure 3 with red pine. Such injuries are not always visible to the eye as in this case. The root cells were disrupted by too rapid revolutions of the dewinger, and they could not grow normally. Such new crop seeds are worthless.

The percentage of hardseededness is clearly shown in laboratory tests. It will tell the planter if special treatment is necessary to overcome this condition, such as scarification or sulphuric acid treatment. Not all hard seeds found in black locust, redbud, etc., are good, viable seeds, as suspected by nurserymen and advocated by certain seedsmen. Many hard seeds are dead or weak seeds. The percentage of strong germinable hard seeds can be found by clipping the hard seeds as shown in figure 4.

Varying degrees of dormancy can be measured in laboratory tests, especially in coniferous seeds. The most dormant species, such as Balkan pine, white pine, balsam fir, Japanese larch and hemlock, may require a few weeks' prechilling for prompt germination. These kinds require fall sowing in the nursery for optimum germination in the spring. Other species, such as Norway spruce, Colorado blue spruce, Austrian pine, Mugho pine and Scotch pine, will germinate promptly in the laboratory without prechilling. These species should not be sown in the fall, as they might pregerminate before winter and be killed. The glauca strain of Douglas fir reacts differently in laboratory tests than the caesia or viridis strains, which exhibit more extreme dormancy.

Certain laboratory seed dormancy tests, seedling color and seedling performance will allow the analyst to detect mislabeling in seeds as to kind, strain and sometimes stated seed source. More studies are under way along this line in checking trueness to labeling of tree and shrub seeds.

Laboratory tests will tell the nurseryman if he is getting plantable, strong seeds or weak, dead seeds. It will give him a check on the germination figure as quoted on the label or by the seed dealer.

Select Proper Seed Source

Besides sowing strong, high-germinating seeds, the nurseryman must select the proper seed source with certain species for complete success. In Mugho pine one must be certain to secure seeds from the true, dwarf, compact trees. Open market seeds may have been collected from the rangy Mugho mountain pines found on the dune plantations in Europe.

For Scotch pine Christmas tree production, if one desires the best green winter needle coloration, he must not plant the Riga, Polish, Swedish, North German nor some of the high mountain strains from central Europe. The writer has been studying seed source behavior in all

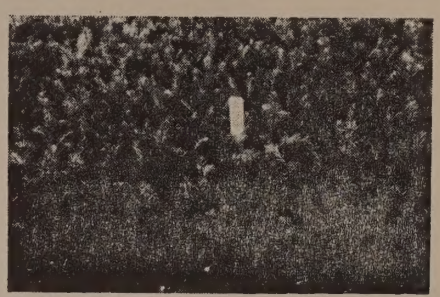

Fig. 5—Thrifty, well-developed Douglas fir 2-year seedlings, 8 to 12 inches in height, as the result of optimum seedbed density.

Scotch pine strains and sources for many years. Needle length, growth rate, branch angle and winter coloration have shown extreme variation in these seed source studies.

Many a nurserymen has had failures in the nursery and in the field with the wrong seed source of Douglas fir. The west coast viridis strain is not winter hardy in north central and northeast United States. Some of the inland viridis and caesia sources from Wyoming, Idaho and Montana are terrifically slow growing and not favored for this reason. Other inland viridis and caesia sources are both fast-growing and winter hardy. The blue glauca sources in the large Rocky mountain region are all winter hardy, but they vary in growth rate somewhat and needle coloration. This success or failure with Douglas fir to date may have been due to the use of seeds from the ideal or the wrong source in a particular area or for a particular purpose. The seed source of the 2-year Douglas fir seedlings shown in figure 5 is the Kiabab national forest, in Arizona, at an 8,500 to 9,000-foot elevation. They showed excellent growth and blue color as 1-year and 2-year seedlings.

Seeds of Norway spruce, Colorado blue spruce, concolor fir, ponderosa pine and many others will exhibit differences in growth rate, needle length, needle coloration, winter

hardiness or other characteristics, depending on seed source.

Dealer Responsible

The seed dealer or seed collector should be held responsible for the quality of seeds he sells. There is no excuse today for seed dealers' selling old, weak, worthless tree seeds either directly from his place of business or through the mail. All seedsmen should have their tree seeds tested for germination before offering them for sale and state the percentage of germination on each lot of seeds. Many nurserymen have bought seeds blindly in the past, paid for the seeds, planted them in the nursery with total failures, as was experienced by one who planted some wistaria seeds which proved unfit when our laboratory tested them after the field failure.

The writer could cite other similar cases, sometimes involving several hundred pounds of seeds and loses in the thousands of dollars, simply because either a seed dealer or a nurseryman or both were careless and ignored the necessity of an official germination test before the seeds were sown in the nursery.

New York state has provisions in its seed law to protect the buyer of tree seeds, as it does for all other types of seed. Tree seeds offered for sale within this state must be correctly labeled as follows: (1) The kind of seed and the variety, (2) the percentage of weight of pure seeds, (3) the percentage of germination, (4) the year or collection of such seeds, (5) the specific locality (state and county in the United States or nearest equivalent political unit in the case of foreign countries) in which seeds were collected, (6) the name and address of the person selling the seeds.

Other states, including Georgia, Michigan, Massachusetts and Pennsylvania, have some provisions in their seed law to protect the nurserymen. Certified tree seeds are being discussed by various groups in certain parts of the United States. Georgia has developed standards for certified seeds of certain southern pines. The Pacific northwest area is studying provisions for certified tree seeds, as are other sections of the country. New York has a committee working on proposed certification seed standards for five coniferous tree species. Certified seed is the final answer for the highest-quality tree seeds, for germination, mechanical and genetic purity and authentic seed source. All nurserymen should promote the establishment of certified tree seed standards in their respective areas.

It should be pointed out here that some progressive, reliable tree seedsmen are making germination tests on all or part of their seeds being offered for sale. It is the buyer's responsibility to request such information from the seed dealer even though his state may not have a tree seed law. One can purchase his seeds on a minimum germination requirement and then secure germination tests from an official state seed laboratory after such seed purchases.

Control Seedbed Density

By knowing the germination percentage of the seeds and the number of seeds per pound, the seeding rate can be regulated so as to give optimum seedling density. This will mean fewer failures or overcrowded seedbeds, both of which will occur without careful attention to these two factors. Well spaced conifer seedlings can be grown from proper seeding rates based on germination percentage and number of seeds sown per a given area, as shown for the Douglas fir in figure 5.

The ideal density of seedlings grown per square foot should vary, depending on species, length of time left in seedbeds and possible use of seedlings. The writer has grown strong, healthy 1-year Scotch pine seedlings two to four inches in height at a density of 100 per square foot and transplanted them at the end of the first year with excellent results. However, for good sturdy 2-year Scotch pine seedlings this density must be reduced to 45 to 60 per square foot. Good, thrifty, well-developed, 2-year seedlings of most spruces and firs can be grown successfully at higher seedbed density, such as 55 to 80 per square foot. If these species are to be left for 3-year seedlings, the density should be reduced to 40 to 55 per square foot. Most nurserymen sow their seeds too thickly, and the writer has observed seedlings of many evergreen species growing in seedbeds as high as 150 to 300 per square foot. The seedlings in these seedbeds are so dense they remind one of bristles of a rug or hair on a dog. Such seedlings are anemic and stunted and even after being transplanted may take two or three years to recover and develop into normal and sturdy transplants.

Seed Count Varies

Seeds per pound will vary considerably within each species, due to many factors, such as seed source, age of tree, cone yield, condition of tree, percentage of empty seeds present and many others. Scotch pine seeds tested from Sweden and the northern Baltic areas have varied from 94,000 to 104,000 per pound, as compared to the seeds tested from Spain, which are much larger and have varied from 34,600 to 49,000 seeds per pound. The most accurate way to determine the seeds per pound on any particuar seed lot is to weigh out one quarter ounce or less, if necessary, and count the seeds, then calculate on an ounce or pound basis for seeding purposes. Don't take figures from averages or ranges in seeds per pound by species as listed or published in various books, because these figures may be extremely inaccurate for your particular seed lot.

The research findings presented in this article have shown that all tree seeds can be tested successfully in the laboratory within a relatively short time. Nurserymen should insist on purchasing high-quality seeds and make the dealer responsible for the seeds he sells. By planting tested seeds of strong, high germination and proper seed source, every nurseryman will have less seedling failures, will be able to cut costs of operation and will produce higher-quality seedlings and transplants for the buying public.